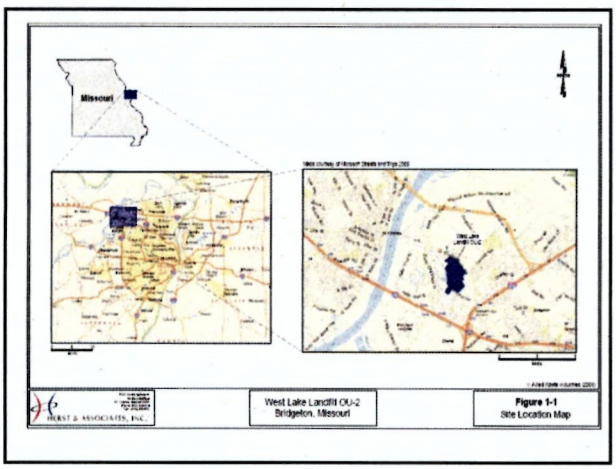
U.S. Environmental Protection Agency
Region 7
Kansas City, Kansas

West Lake Landfill Site
Region 7

- Bridgeton, Missouri
- Municipal Landfill Site
- OU-1 > Radiologically Contaminated Units
- OU-2 > Other Landfill Units



Site Boundaries

0714

40477004

Superfund

6.0

Title goes here

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Site Areas – Operable Unit 1

- Radiological Area 1 and Area 2 – received municipal refuse, construction/demolition debris and radiologically contaminated soil. Operated pre-1974.
- Buffer Zone/Crossroad Property (Ford Property) – became radiologically contaminated from erosion event at Area 2.

Site Areas – Operable Unit 2

- Closed Demolition Landfill – operated under state permit and was closed in 1995.
- Former Active Sanitary Landfill – Bridgeton Landfill operated under state permit and ceased operation in 2005.
- Inactive Sanitary Landfill - received municipal refuse, construction/demolition debris pre-1974.

Public Process

- Proposed Plan for the containment remedy was issued June 12, 2006.
- First public comment period opened June 14, 2006 and after several extensions was ended December 29, 2006 (open more than 6 months).
- Two public meetings were held during this period – the 1st on June 22nd and the 2nd on September 14th.

Public Process (cont.)

- In response to further comment on the levee system and floodplain issues, EPA reopened the public comment period and held a 3rd public meeting on March 27, 2008.
- The second comment period was closed April 9, 2008.

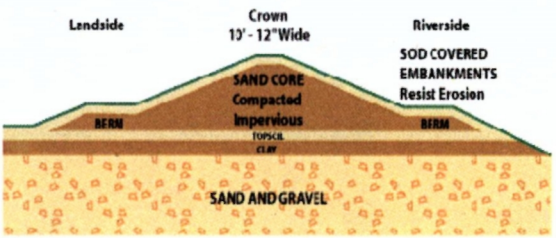
Third Public Meeting on the Earth City Levee District and Floodplain issues

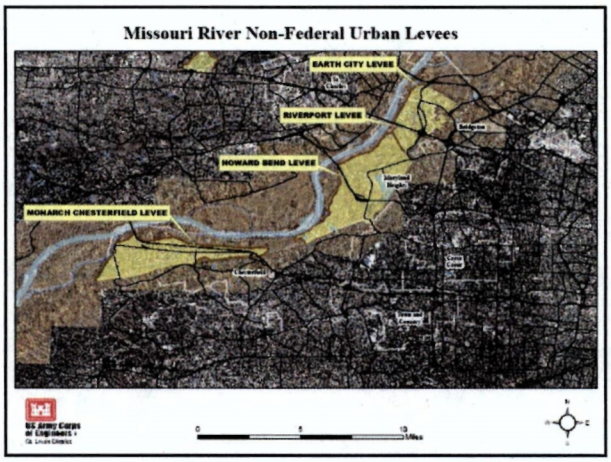
- Presentations given by the Levee District manager, St. Louis District Corps of Engineers Program Manager, and Region 6 RPM on Superfund site inspections post-Katrina.
- Earth City Levee performed as designed in 1993 500-year flood.
- The protectiveness of the West Lake Landfill containment remedy is not dependent on levee performance.

Earth City

- 1,891 Acres
- 19 Million s.f. of Buildings
- 475 Businesses
- 24,000 Employees

Cross Section of an Engineered Levee

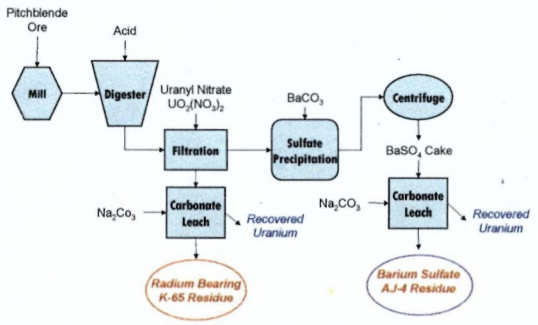




All Engineered Levees Performed as designed in 1993

- The Vast majority of levees that "failed" were agricultural, most were overtopped. Overtopping is not a failure. It is the exceeding of the design criteria for the levee.

Historic Pitchblende Ore Processing St. Louis



Ore Processing Residues

K-65 Residue
(Gangue Lead Cake)

- ThO_2, $RaSO_4$, and $PbSO_4$
- 600 mg radium per ton residue
- 0.2% uranium

SLAPS

Lake Ontario Ordnance Works, NY
Fernald, OH

AJ-4 Residue
(Barium Sulfate Cake)

- Leached $BaSO_4$ with small amounts of $RaSO_4$
- 4×10^{-9} g $RaSO_4$ / g residue (~3 mg radium per ton of residue)
- 0.1% uranium

SLAPS

Latty Avenue

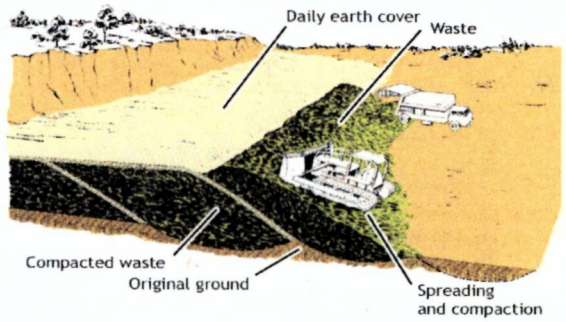
West Lake Landfill, MO

West Lake Landfill

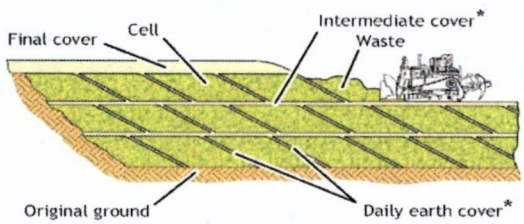
Events of 1970

- 8,700 tons leached barium sulfate cake (uranium 0.03% - 0.1%) left over from AEC ore residues sent to Colorado for reprocessing.
- U concentrations and leach potential too low for commercial reprocessing.
- Mixed with 39,000 tons of soil (4.5 to 1).
- Transported to landfill and used as daily and intermediate cover at Areas 1 and 2.
- Contaminated soil was placed sometime between August and November 1970

GENERALIZED LANDFILL OPERATION



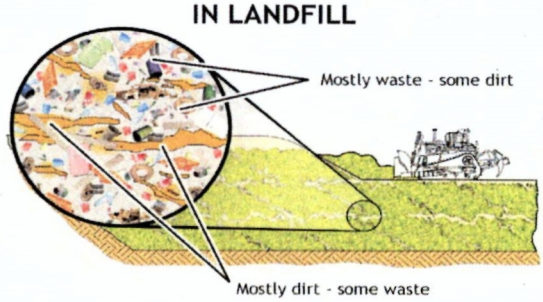
GENERALIZED LANDFILL CELL CONFIGURATION



*Idealized soil layers. This configuration does not reflect mixing of soil with trash or distortion of soil layers by subsequent compaction and placement of additional fill.

Cross Section

TYPICAL MIXING OF WASTE AND DIRT IN LANDFILL



Extensive Site Characterization Has Been Performed

US Nuclear Regulatory Commission

- Radiological Survey (Radiation Management Corp, 1980 - 1982) sufficient to allow engineering evaluation, included:
  - overland gamma surveys;
  - surface soil sampling (61 samples);
  - extensive boring program: 75 holes &19 detailed gamma logs;
  - groundwater sampling investigation;
  - air investigation, gaseous and particulate, and;
  - vegetation sampling

Characterization Efforts (cont.)

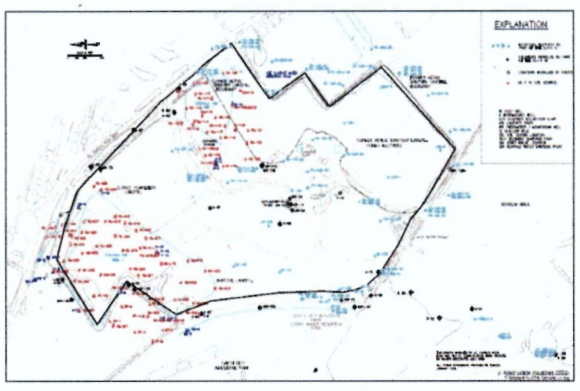
EPA Region 7 (PRP enforcement lead)

- Overland Gamma Survey Report (McLaren/Hart 1996)
- Site Reconnaissance Report (McLaren/Hart 1996)
- Radon Gas, Landfill Gas and Fugitive Dust Report (McLaren/Hart 1996)
- Rainwater Runoff, Erosional Sediment, Surface Water, and Leachate Sampling Data Report (MLaren/Hart 1996)
- Soil and Groundwater Sampling Data Summary Report (MLaren/Hart 1996)

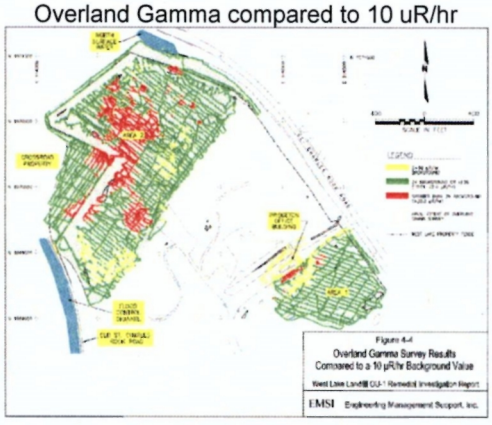
Characterization Efforts (Cont.)

- Groundwater Conditions Report (MLaren/Hart 1996)
- Soil Boring/Surface Soil Investigation Report (MLaren/Hart 1996)
- Site Characterization Summary Report (EMSI 1997)
- Hydrogeological Characterization Report (Golder Associates 1997)
- Environmental Investigation and Health Impacts Assessment, Bridgeton Landfill (Golder Assoc. 1993)
- Radiological Survey (Golder Associates 1996)

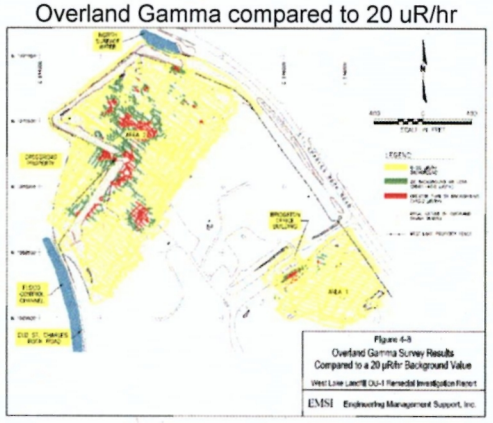
Site Sampling Locations



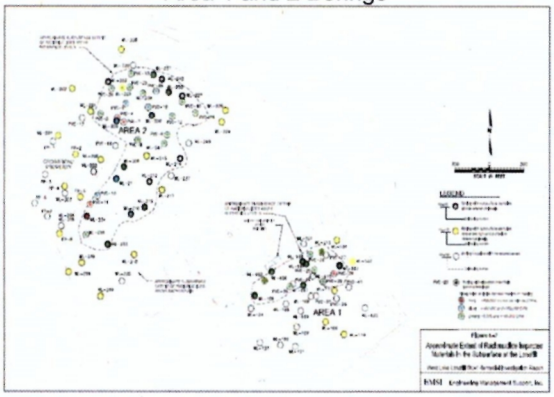
Overland Gamma compared to 10 uR/hr



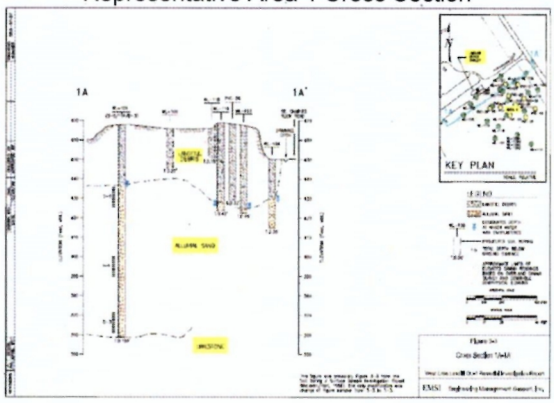
Overland Gamma compared to 20 uR/hr



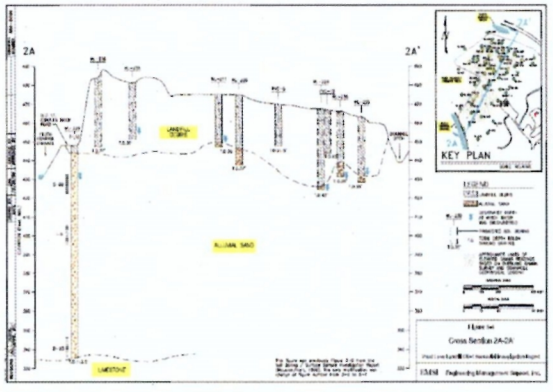
Area 1 and 2 Borings



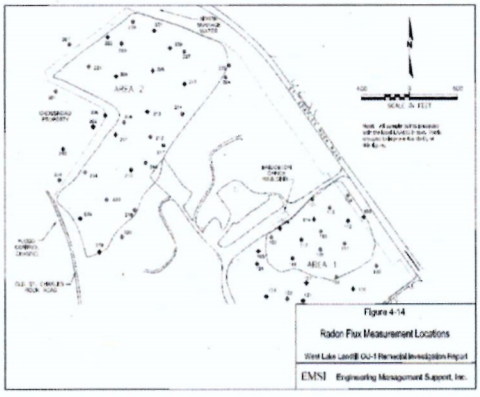
Representative Area 1 Cross Section



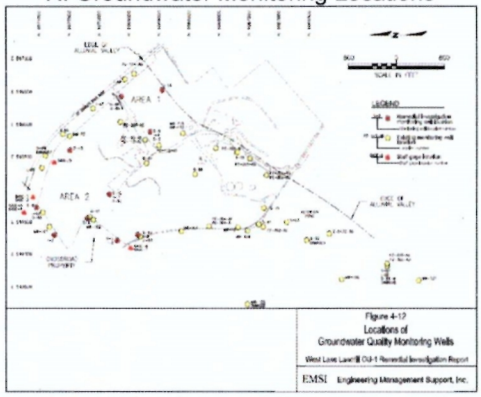
Representative Area 2 Cross Section



Radon Flux Measurement Locations



RI Groundwater Monitoring Locations



Excavation, what is involved…

- Waste handling/sorting/stockpiling
- Health & Safety challenges
- Contaminant migration/spreading concerns
- Waste hauling/transportation issues
- Lengthy schedule
- Cost considerations
- Uncertainties

Excavation and Commercial Disposal Feasibility

- Excavation Volumes
- Radionuclide Activity
- Disposal Options
- Cost Evaluation

Extent of Radiologically Contaminated Materials

- Top 10 to 20 feet over about 30 acres combined
- In-situ radiologically impacted volume = 146,000 bank cubic yards (BCY).
- Vertical distribution of impacted material is highly variable even over short horizontal distances.
- Excavation would result in unavoidable aggregation of impacted and unimpacted material.
- Bulking factor must also be applied

Excavation Volumes

- Area 1 72,000 BCY
- Area 2 360,000 BCY
- Ford Property 7,000 BCY

Total Excavation Volume 440,000 BCY

Excavation Volumes

assuming 20% segregation of unimpacted material

Impacted Area	Excavated Volume (BCY)	Material Returned as Backfill (BCY)	Transportation and Disposal Volume (BCY)
Area 1	72,000	14,000	58,000
Area 2	360,000	72,000	290,000
Ford Property	7,300	1,500	5,800
Total	440,000	88,000	350,000

Notes:

BCY Bank cubic yards

Transportation/Disposal Volumes and Weights

Tonnage of Impacted Material

350,000 BCY x 1,500 lbs/BCY = **260,000 tons**

Loose Volume of Impacted Material

350,000 BCY x 1.3 expansion factor = **460,000 LCY**

Radionuclide Concentrations in Aggregated Waste

Aggregation Scenario	Average Ra-226 Concentration (pCi/g)	Average Th-230 Concentration (pCi/g)
AJ-4 residue with no aggregation	3,000	30,000
Contaminated soil mixture from RI data	189	2,140
Material resulting from the excavation and aggregation of 260,000 tons of waste material	50	300

Potential Disposal Facilities

Representatives of six disposal facilities were contacted. Only the following two are feasible or reasonable options:

- American Ecology – Grand View Idaho
- Energy Solutions – Clive, Utah

Energy Solutions – Clive Utah Costs

Disposal Fees

- $295 per cubic yard (negotiable based on commitment)
- $115.18 per cy - USACE contract rate for soils (rates are much higher for debris, oversized debris and RCRA characteristic)

Transportation Fees

- $7,000 plus per gondola car

Cost Evaluation

COST ASSUMPTIONS FOR EXCAVATIONS

Area	Aerial Extent of Excavation (sq ft)	Depth of Excavation (ft)	Volume of Excavation (BCY)	Volume of Material Returned to Excavation as Backfill (BCY)	Dimensions Used to Model Excavation in RACER (length·width·depth)
Area 1	193,915	10	72,000	14,000	440 ft · 440 ft · 10 ft
Area 2	817,055	12	360,000	72,000	904 ft · 904 ft · 12 ft
Ford Property	196,000	1	7,300	1,500	443 ft · 443 ft · 1 ft

Notes:

BCY Bank cubic yards
ft Feet
sq ft Square Feet

Total Estimated Cost

for excavation, transportation, and disposal of 460,000 LCY

- $130 million (assuming USACE contract rate for soils).
- $220 million (assuming rate quote from company source)

Schedule

- Assuming a typical $15 million per year funding stream full excavation and disposal could take approximately 13 years.

Potential Short-Term Risks

- Worker Safety concerns
- Potential releases due to spills or migration
- Odor emissions and bird problems (Airport safety issue).

Worker Health & Safety

- Personal Protective Equipment (PPE) -respirators, protective suits
- Gamma exposure
- Physical stress – time limits
- Physical hazards – slip, trip, fall, machinery
- Work place monitoring

Contaminant migration/spreading

- Fugitive dust – airborne migration
- Fugitive dust control – water application
- Leachate generation
- Equipment decontamination water
- Water from open excavations

Waste Hauling & Transportation Issues

- Truck decontamination
- Transfer facilities
- Increased local truck traffic
- Waste hauling on public roads
- Interstate transit by rail
- DOT requirements
- Safety issues

Transportation Risks

Excavation and commercial disposal would involve:

- 23,000 truck loads to rail load out.
- 460,000 round trip distance on public roads to railhead 10 miles away.
- 5,750 Gondola Cars or 57 100-car trainloads.
- 183,000 miles of rail distance

Class I Railroads of North America

- Limited number of railroads between St. Louis, MO and Salt Lake City, UT

Truck Route to RR Spur

Transporting Waste from Landfill to Rail car

- Amount of hazardous fill to move = 460,000 cubic yds
- Number of truckloads from West Lake Landfill to railhead = 23,000
- Number of Truck miles = 345,000
- Estimated number of accidents = 1.3

*Assuming 3.8 accidents/1,000,000 truck miles

Additional Risk with Transporting Waste on Rail to Utah

- Number of railcars to transport waste from St. Louis to Clive Disposal Facility = 5,750 railcars
- Assume 100 railcars/trainload = 57 trains
- Train miles = 170,000
- Risk of injury or death = 4

*one injury or death for every 42,720 train miles

Potential Short-Term Risks (cont.)

- Transportation risk of injury or death from excavation and disposal is greater than 1
- Contrast with the current no-action risk to a groundskeeper of 4×10^{-5}
- Contrast with-future no action risks to hypothetical storage yard worker of 4×10^{-4}
- Thus the transportation risk alone of moving the material is 1000s of time greater than the calculated risk of doing nothing.

Partial Excavation Alternative

- Due to the wide-spread and variable distribution of the contaminated soil, targeted excavation would be unlikely to yield a disproportionate amount of the radiological content.

Partial Excavation Alternative (cont.)

- Targeted recovery of radiologically impacted material could be achieved through wholesale excavation and separation of the soil fraction from the refuse, e.g., using a grizzly or vibrating screen.
- This would be a difficult, time and labor consuming, potentially hazardous activity to workers and the public.